Abstract

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Superplastic Deformation and Cavitation In Two Microduplex Stainless Steels*

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The superplastic deformation and cavitation behavior in two microduplex stainless steels have been studied in the temperature range of 900°C to 1050°C. The materials contained equal volume fractions of austenite and ferrite. However, the two materials, which developed recrystallized microstuctures before and during testing, showed significant differences in grain size and grain size distribution. One material had a mean grain size of 5 μm, while the other had a more banded microstructure with a bimodal grain size distribution and a mean grain size of approximately 10 - 15 μm. The stress-strain-strain rate behavior, active deformation mechanisms and cavitation response of these two materials have been studied and compared to other microduplex stainless steels. Grain boundary sliding and slip creep have been found to be the dominant deformation mechanisms and no threshold stress was observed. In both materials, cavitation was found to occur in distinct bands that corresponded to regions containing high concentrations of austenite in the ferrite matrix. In the fine grained material, cavity formation was observed to occur at ferrite-austenite interfaces and, in the coarse grained material, cavity formation occurred at ferrite-austenite interfaces as well as the interior of the ferrite matrix. The cavity growth rates for both materials have been studied.

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